Friedrich Heinemann und Martin G. Kocher: Tax compliance under tax regime changes

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Tax compliance under tax regime changes[*]

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Abstract: In this paper we focus on the compliance effects of tax regime changes. According to the economic model of tax evasion, a tax reform should affect compliance through its impact on tax rates and incentives. Our findings demonstrate the importance of at least two further effects not covered by the traditional model: First, reform losers tend to evade more taxes after the reform. Second, a reform from a proportionate to a progressive system decreases compliance compared to a switch in the reverse direction. However, the level of compliance is generally higher under a progressive than under a proportionate regime.

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1 Introduction

Changes to the degree of a tax system's progressiveness are a key element of many introduced or considered tax reforms. For decades, income tax reforms in industrial countries have been characterized by a combination of base broadening and cuts in tax rates (OECD, 2006). Especially, flat tax reforms have received increasing attention resulting from their popularity among Eastern European countries (Keen, Kim and Varasano, 2008). Proponents claim that their simplicity and incentives raise compliance (for surveys of the tax compliance literature, see Andreoni, Erard and Feinstein, 1998; Torgler, 2002; Kirchler, 2007). Indeed, on the basis of household panel data, Ivanova, Keen and Klemm (2005) find that the Russian flat tax reform from 2001 has been associated with a higher degree of compliance. A similar result regarding the Russian reform is reported by Gorodnichenko, Martinez-Vasquez and Peter (2009).

However, natural experiments do not allow for an unambiguous identification of the driving forces behind tax compliance, because it is very difficult to disentangle several competing explanations. Relevant variables such as the tax tariff, changes in the effectiveness of the tax administration, and the general social and economic environment change concurrently. Moreover, the impact of reforms on compliance cannot be measured precisely from field data or surveys because of the secret nature of tax evasion. Studies that rely on field data, therefore, have to estimate tax evasion through observable variables such as the consumption-income gap.

In this paper, we analyze the effects of tax regime change in a laboratory experiment. Laboratory experiments can be viewed as complementing to the existing results based on field data. They are especially helpful in isolating the behavioral effects that drive any difference in compliance between tax regimes. Furthermore, they allow to causally ascribing changes of behavior to exogenous treatment variations. To our knowledge, none of the contributions to the large experimental tax compliance literature has taken on that subject. So far, the focus of most papers were on explaining the difference between compliance predicted by the seminal model of Allingham and Sandmo (1972) as well as subsequent models, on the one hand, and observed compliance on the other hand (e.g., Alm, McClelland and Schulze, 1992; Alm, Jackson and McKee 1992, 2009; Alm, Sanchez

and De Juan, 1995; Feld and Frey, 2002, 2007; Torgler, 2005; Maciejovsky, Kirchler and Schwarzenberger, 2007).[1]

In our experiment, we implement an environment that depicts the compliance decisions through fully incentivized, individual decisions on tax compliance in a repeated setting. More specifically, experimental subjects face one tax regime for a certain commonly known number of income statement decisions before they experience another regime. Our first and foremost focus in this study is on the impact of a reform on individual tax compliance from a progressive towards a proportionate tax tariff and vice versa. However, our experiment features two further interesting aspects: First, we let our participants choose between the two tax regimes that they encounter during the experiment after they have experienced both regimes. Such a choice that is implemented under increased monetary incentives provides us with valuable information regarding tax system preferences. Second, an innovative feature regarding our experimental design is that the taxable income in the experiment depends on individual achievements (see also Anderhub et al., 2001) before the introduction of the tax game. This feature induces stronger entitlements over the taxable income and increases the external validity of our experimental setup.

Our empirical results corroborate the view that compliance is affected by regime changes beyond the predictions of the traditional economic model of tax evasion. As predicted by the traditional model, the proportionate system, due to its lower tax rate, is characterized by a lower share of income honestly declared. Beyond this level effect, there is however an interesting impact of the direction of reform: A change from a progressive to a proportionate system is significantly more beneficial for a public authority in terms of tax compliance than a switch in the reverse direction. This result hints to the importance of the pre-reform point of reference in the individual compliance decision. Furthermore, reform losers tend to evade taxes to a greater extent after the reform compared to reform winners. Again, theories including reference points or aspiration levels are able to organize our data well. The preference for one of the two systems on the individual level is strongly

[1] The difference between predicted and observed compliance does not only hold for studies based on survey or field data but also for experimental studies where "in most cases the level of tax compliance was higher than predicted" (Torgler, 2002, p. 677).

influenced by monetary considerations. Other considerations and individual characteristics play a minor role in shaping this preference in our experiment.

The paper is structured as follows: After describing the underlying model and our experimental design (in section 2), we go on by deriving theoretical hypotheses in section 3. Section 4 provides details on our laboratory setup, and section 5 contains our results regarding tax compliance. In section 6, we present the results on tax regime preferences, and, finally, section 7 discusses our empirical findings and concludes the paper.

2 Model and experimental design

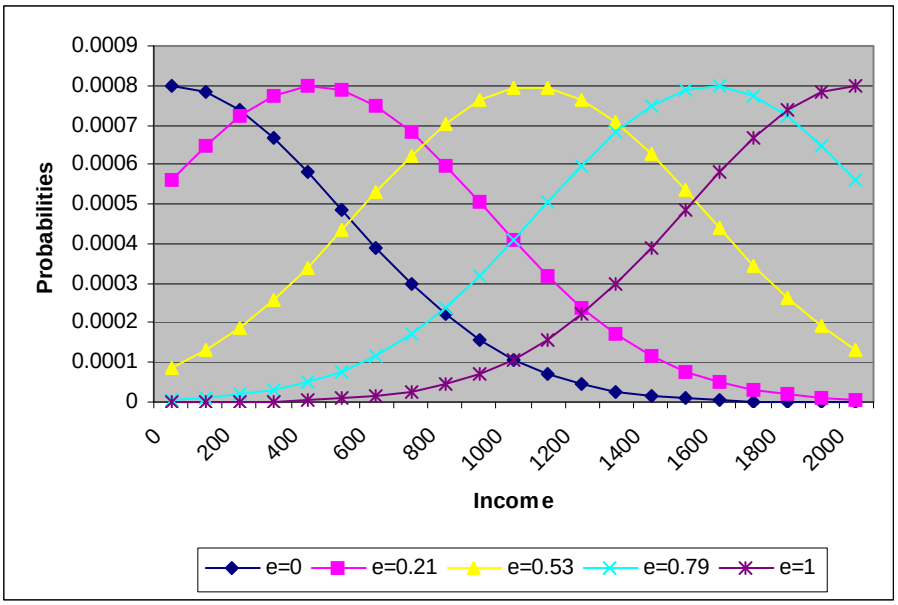
Our experimental design extends the standard experimental approach to study tax compliance decisions in at least three respects. First, we model individual expected income to depend on individual achievements in order to induce stronger entitlements over the taxable income. Second, individuals experience a fundamental tax regime change from a proportionate towards a progressive system and vice versa. And third, subsequent to the experience of both tax regimes, participants can choose their preferred tax regime and decide about compliance in final period with strongly increased monetary incentives.

In our experimental setup the incomes of $i \in I$ individuals in period t, $Y_{i,t}$, is distributed over the closed interval [0,2000]. The expected income $E[Y]$ of the population is equal to 1000 but the individual probability distribution is dependent on an individual characteristic $e_i \in [0,1]$ that is an indicator for relative ability to earn income. Each individual is assigned this parameter in a way such that the relatively best-performing individual is assigned $e_i = 1$ and the least-performing individual $e_i = 0$. If n is the number of individuals in the economy, $1/(n-1)$ is the difference between two adjacent e-values. The parameter e_i can be interpreted as a general, time-independent personal pre-disposition for the ability to earn income with $\partial E[Y]/\partial e_i > 0$.

More specifically, an $e_i > 0.5$ shifts the expected value of individual income in a given period $E[Y_{i,t}]$ to the right, and an $e_i < 0.5$ shifts the expected value of individual income $E[Y_{i,t}]$ to the left of the median income while, however, leaving the population

expected income unchanged.[2] In the experiment, the individual probability distribution over income is normally distributed with $X = N(\mu_i ; \sigma^2) = N(\mu_i ; 500^2)$ with cut-offs at 0 and 2000, and e_i is proportional to μ_i, i.e. $\mu_i = 2000 e_i$. As an illustration, Figure 1 shows the distributions for e=0, e=0.21, e=0.53, e=0.79 and e=1.

Figure 1: Probability distribution of income for an economy with 20 individuals



In each period $r \in \{1, 2, ..., R\}$ individuals learn their actual income and have to declare an amount $0 \le D_{i,r} \le Y_{i,r}$. $D_{i,r}$ is taxed according to a tax function $T_{i,r}$ that can take on two forms (the two tax regimes): (i) either being *proportionate* with $T_{i,r}^{prop} = t * D_{i,r}$, or (ii) being *progressive* with $T_{i,r}^{prog} = t\, D_{i,r}(D_{i,r} - g)/f$ if $D_{i,r} \ge g$ and 0 otherwise, where *t*, *g* and *f* denote tax scale parameters, and *g* is at the same time the tax-free income.[3] Table 1

[2] This is an important feature when introducing a tax regime change because it allows us to directly compare the two regimes.

[3] For reasons of parsimony and analytical clarity we chose very easy tax regimes. Moreover, straightforward tax formulae make it much easier for subjects to understand their task. Since we do not intend to bring existing real-world tax regimes into the laboratory, we will not interpret the absolute level of tax compliance. Our focus is on the causal effects of our treatment variations. For the latter, clear incentive effects facilitate inferences on behavioral consequences of tax regime switches.

displays the tax function. Note that the expected revenues of the two tax regimes are identical.[4]

Table 1: Overview of tax regimes

	Progressive tax regime		**Proportionate tax regime**	
Income	Average tax rate	Tax amount	Average tax rate	Tax amount
0	0.00	0.00	0.25	0.00
100	0.00	0.00	0.25	25.00
200	0.00	0.00	0.25	50.00
300	0.00	0.00	0.25	75.00
400	0.00	0.00	0.25	100.00
500	0.00	0.00	0.25	125.00
600	0.016	9.72	0.25	150.00
700	0.046	32.34	0.25	175.00
800	0.076	60.96	0.25	200.00
900	0.106	95.58	0.25	225.00
1000	0.136	136.20	0.25	250.00
1100	0.166	182.82	0.25	275.00
1200	0.196	235.44	0.25	300.00
1300	0.226	294.06	0.25	325.00
1400	0.256	358.68	0.25	350.00
1500	0.286	429.30	0.25	375.00
1600	0.316	505.92	0.25	400.00
1700	0.346	588.54	0.25	425.00
1800	0.376	677.16	0.25	450.00
1900	0.406	771.78	0.25	475.00
2000	0.436	872.40	0.25	500.00

Tax jurisdictions are formed out of $1 < m < n$ individuals, and tax revenues within a jurisdiction (i.e., $\sum_{i=1}^{m} T_{i,r}(D_{i,r})$) are divided equally among the m individuals each period. A tax audit take place with a commonly known probability p, and failing to comply with $D_{i,r} = Y_{i,r}$ in the audit leads to a fine s, with $s_{i,r} = q[T_{i,r}(Y_{i,r}) - T_{i,r}(D_{i,r})]$, i.e., q times the evaded tax in this period. Thus, we have implemented the Yitzhaki (1974)-type of fine which safeguards that the expected effect of a tax rate increase has an unambiguously positive effect on compliance (see below). Fines are forfeit and are not redistributed within the jurisdiction. Tax evasions that are not detected do not bear any consequences.

[4] Our experimental program induced the expected income *E[Y]* of the population to be slightly skewed to the right and, hence, the expected revenues of the two tax regimes were not completely identical in the experiment. All our results and conclusions are unaffected by this feature.

Thus, a player i faces the following payoff function in a single period (suppressing the time index):

$$\pi_i = p\{Y_i - T(D_i) - q[T(Y_i) - T(D_i)] + \frac{\sum_{j=1}^{m} T(D_j)}{m}\} + (1-p)[Y_i - T(D_i) + \frac{\sum_{j=1}^{m} T(D_j)}{m}] \qquad (1)$$

In the experiment we choose the following parameters: size of the jurisdiction m = 2, size of the economy n = 10, audit probability p = 0.15[5], the fine rate q = 3, the tax function parameters g = 546, f = 1,500, t = 0.45 and the proportionate tax rate t^* = 0.25.

3 Theoretical predictions for our setup

This section presents theoretical considerations regarding the effects of tax regime changes on tax compliance. We deliberately focus only on the consequences of regime change and leave aside more general issues of tax compliance that have been discussed extensively elsewhere for reasons of succinctness.

3.1 Compliance within the standard model with and without risk aversion

In the model of Allingham and Sandmo (1972, henceforth: AS) tax cheating is regarded as an investment into a risky asset. By hiding a certain fraction of income tax payers embark on a lottery with two possible outcomes: Either they are not caught and "earn" the tax on the income not declared or they are audited and lose the fine. Key parameters that, according to the AS-model, drive tax compliance are the fine rate, the audit probability, the tax rate, the level of income, and individual risk preferences. Ceteris paribus, investment into tax cheating will be the larger, the lower the risk of detection (determined by the audit system and the audit probability), the lower the potential loss (determined by the construction and the size of the fine), the higher the potential return (determined by the tax rate) and the lower individual risk aversion (which is usually negatively correlated to income).

[5] Like in many other experiments, we choose an auditing probability that is considerably higher than the one in the real world. This is to account for the fact that several real-world leveraging effects of auditing such as potential social disapproval after being caught cheating or increased auditing scrutiny after once being caught cheating are not separately modeled in our experiment.

Based on the AS-model and the model by Yitzhaki (1974) it is easy to show that for both of our tax regimes – the progressive and the proportionate tax – that risk-neutral money-maximizing individuals would always declare $D_{i,t} = 0$. A tax regime change should therefore have no influence on behavior of selfish and completely rational decision maker.

Hypothesis 1 (risk-neutral rational): The regime change has no effects on compliance.

If we assume that a decision maker cares about risk, one can work with different functions. When choosing constant relative risk aversion (CRRA), we obtain the following expected utility function for a subject *i*:

$$EU_i = p\{Y_i - T(D_i) - q[T(Y_i) - T(D_i)] + \frac{\sum_{j=1}^{m} T(D_j)}{m}\}^{1-r} + (1-p)[Y_i - T(D_i) + \frac{\sum_{j=1}^{m} T(D_j)}{m}]^{1-r} \quad (2)$$

The parameter *r* accounts for risk attitude. Subject *i* is risk averse if $r > 0$, risk neutral if $r = 0$ and she prefers risk if $r < 0$. If $r = 1$, we use the natural logarithm, and if $r > 1$, division by $(1 - r)$ is necessary for expected utility to increase in E_{Dj} (Holt and Laury, 2002).

For our specific tax functions we obtain:

$$EU_i = p\{Y_i - tD_i - q[tY_i - tD_i] + \frac{tD_i + tD_j}{m}\}^{1-r} + (1-p)[Y_i - tD_i + \frac{tD_i + tD_j}{m}]^{1-r} \quad (3)$$

and

$$EU_i = p\{Y_i - tD_i(D_i - g)/f - q[tY_i(Y_i - g)/f - tD_i(D_i - g)/f] + \frac{tD_i + tD_j}{m}\}^{1-r} + (1-p)[Y_i - tD_i(D_i - g)/f) + \frac{tD_i + tD_j}{m}]^{1-r} \quad (4)$$

if $D_{i,r} \geq g$ and 0 otherwise.

Differentiation with respect to D_i and optimization yields the optimal D_i (with an ugly expression for the linear case and no closed-form solution for the progressive case). It is important to notice that all determinants of tax evasion according to the AS-model (the fine rate, the audit probability, the level of income, and individual risk preferences) are constant across our two tax regime, with one important exception: the marginal tax rate. By running simulations[6] it is neither difficult to show nor surprising that we confirm a result which is well-known from the literature: In the original AS-model, the fine is

[6] Simulations are available on request.

constructed to be proportionate to the *income* evaded. Under this assumption raising the tax rate has an ambiguous effect on compliance. On the one hand, it lowers net income which should make people more risk averse under the standard assumption of absolute risk aversion falling with income. On the other hand, a higher tax rate increases the returns to cheating without increasing the size of the fine, since the latter depends on the income evaded. By contrast, the effect is unambiguous if the fine is proportionate to the *tax* evaded (Yitzhaki, 1974): The income effect and the substitution effect now both work towards more compliance with an increasing tax rate. With the Yitzhaki-type of fine we would expect tax compliance to increase (decrease) if a tax reform increases (decreases) the tax rate.

Hypothesis 2 (risk-avers rational): The regime change should only have an effect for risk averse agents through the change in the marginal tax rate.

3.2 Compliance with social preferences and fairness perceptions

Social preferences could play a role in determining the choice of the preferred tax system, besides one's own income. However, they should play a much less important role when it comes to income declaration and compliance.

Since there are almost no models of social preferences under uncertainty (one exception is Trautmann, 2009) and since there are problems regarding central assumptions when extending outcome-based social preference models such as Fehr and Schmidt (1999) or Bolton and Ockenfels (2000) to risky decisions, it is beyond the scope of this paper to derive theoretical predictions based on specific models. Such an approach would require very strong assumptions on beliefs and would not be able to provide much more insight than one gets when pursuing a less formal route.

First, it is obvious that efficiency-based arguments for social preferences (e.g., Charness and Rabin, 2002) do not predict any difference in compliance for our two regimes, because the efficiency parameter of the public good that is financed through tax payments is equal to one in our setup. Hence, we deliberately chose our setup such that paying taxes has no effect on overall efficiency. Inequity-averse decision makers, however, could have an incentive to declare their true income if their income is above average. Below-average income earners cannot reduce the gap between their final profit and the

final profit of a tax payer with average income in the two-person economy through being over-compliant compared to a model without social preferences.[7] Conversely, above-average income earners can reduce the gap between their final profit and the final profit of a presumably poorer companion tax payer by reporting their income truthfully. Thus, if their aversion against advantageous inequality is strong enough, the existence of social preferences will increase compliance. Every linear model for a given risk parameter would imply either optimal compliance according to the standard model with risk (if individual advantageous inequality aversion is below the threshold) or full compliance (if individual advantageous inequality aversion is above the threshold).[8]

Any tax regime that is more progressive makes it easier on the individual level to tip the balance to full compliance for a given individual level of advantageous inequality aversion. Such an effect, however, is only possible for decision makers with social preferences, and it requires an outcome- and equality-based perspective. If, in contrast, our experimental participants view the income differences as fair, because they are a consequence of performance in an effortful task (following the equity concept), social preferences should not play any role in our tax game. Hence, if at all, social preferences should not be a determinant for the decision to comply with the rules.

> *Hypothesis 3 (social preference): The regime change from a proportionate tax system to a progressive one should (weakly) increase compliance for decision makers with social preferences. The effect should be opposite for the change from a progressive system to a proportionate one.*

The perceived fairness of a tax regime is an important determinant for tax evasion or tax compliance decisions. Notice that perceived fairness alludes to the perception on how fair the tax system is for an individual. Perceived fairness can, therefore, exert an influence on compliance that is separate from individual social preferences, but it is of course

[7] They can reduce this gap through declaring zero if the richer decision maker in the two-person economy declares a positive amount, but in that case it is hard to identify whether the poorer decision maker has standard or other-regarding preferences.

[8] Models of intentional social preference could also matter in our context. Wee will, therefore, control for beliefs of individuals in our empirical analysis by means of a question regarding the expected average compliance rate.

associated with social preferences. Spicer and Becker (1980), for instance, have provided evidence that people who believe that the tax system treats them unfairly relative to others tend to engage in more tax evasion to restore equality, but such reasoning depends on the assumption that others truthfully report their income, which usually is not the case in equilibrium.

It is not straightforward to measure such fairness perceptions, because they are often closely linked to self-interest: Based on a survey of US citizens, Bobek and Hatfield (2001) show that the perceived fairness of the introduction of a flat tax is driven by the individual gains or losses (see also the next subsection), pointing to the relevance of a self-serving bias also in the context of assessments of tax regime changes. The essence of the self-serving bias is "to conflate what is fair with what benefits oneself" (Babcock and Lowenstein, 1997, p. 110). Regarding tax regime change, we thus expect an influence of the perceived fairness of the system on compliance, in line with the previous literature.

Hypothesis 4 (perception): Beyond the impact associated with changing tax parameters, a tax reform should increase (decrease) compliance for those who perceive the new regime as more fair (less fair).

3.3 Compliance with reference-dependent preferences

The problem with reference-dependent preferences is that any prediction hinges critically on the assumption regarding the reference point. In our case the most natural candidate for the reference point or aspiration level is the average tax that one paid before the regime change. There is already some empirical evidence that individual gains and losses after a tax reform should matter when it comes to the decision how much income to declare (Bobek and Hatfield, 2001). Hence, a hypothesis regarding the reaction to a tax regime change is easy to formulate without going into details of reference-dependent preference models.[9]

[9] A motive of "loss repair" could also do the trick. Andreoni, Erard and Feinstein (1998) explain the unexpectedly negative effect of audits on compliance with the intention to get back some of the money foregone after a fine. In analogy, a tax reform confronting the individual tax payer with losses should lead to more evasion motivated by a compensation strategy.

Hypothesis 5 (reference-dependence): An increase of the expected tax burden after the regime change should, ceteris paribus, decrease compliance and vice versa.

4 Laboratory details

As already mentioned, entitlement over money is strengthened by making the individual ability-to-earn-money parameter e_i dependent on the individual performance in a quiz at the beginning of the experiment. The quiz contained 20 trivia questions (which can be found in Appendix B). Each of them offered four possible answers of which only one was correct. Subjects learned that their endowment in later parts of the experiment will depend on their performance in the quiz, and they learned in the instructions (see Appendix A) for the tax game that per-period income contains a stochastic component, but they did not learn in what exact way income was determined. Specifically, in the instructions there was no reference to the tournament-like or relative nature in which e_i was determined.

Each of our four experimental sessions followed the protocol described below. Twenty subjects were welcomed to the laboratory and received written instructions for the trivia quiz (part one in the instructions) and the first part (part two in the instructions) of the tax game (either under the progressive tax regime in two sessions or under the proportionate tax regime in the other two sessions).[10] At this stage, participants only knew that there would be further parts of the experiments but had no idea on their contents. The instructions were read aloud, and we gave plenty of time to ask private questions before we started the experiment.

Upon completion of the second part of the experiment, subjects received written instruction that were again read aloud for part three of the experiment (the tax game under a progressive tax regime or under a proportionate tax regime, depending on the order of parts in a specific session). Hence, we implemented a within-subject design. Both tax game parts (periods r_1-r_{10} and periods r_{11}-r_{20}) lasted for ten periods each, and this was common knowledge at the beginning of each part. Before the final period $r = 21$ (denoted part four

[10] Providing subjects with instructions for the first two parts right away helps to make the claim that later endowments depend on the performance in the quiz more evident.

in the instructions), subjects in the experiment are asked which tax regime they prefer, and this regime is, then, implemented for the final period for the individual decision-maker. Monetary incentives for this final period were five times higher than for a period in the previous parts in order to make the self-selection into the preferred regime highly salient. Each period subjects were paired (remember, $m = 2$) randomly in a stranger design (this was common knowledge) in matching groups of size ten for obtaining one statistically independent observation. At the end of each experimental session, subjects went through a risk test (Holt and Laury, 2002) and were asked to answer several attitudinal (tax morale) and personal (socio-economic variables) survey questions.

The experiment was run with the help of z-tree (Fischbacher, 2007), and invitations were administered with Orsee (Greiner, 2004). In total, we had 80 participants (students with a variety of backgrounds) in four sessions, each of them lasting less than two hours. Subjects earned € 24.15 on average. During the experiment, earnings were framed in experimental points with a pre-announced exchange rate of experimental points into euro. Sessions ended with private, in-cash payment.

5 Experimental results

We first present a short overview of the main descriptive results of our experiment (section 5.1). Then, section 5.2 investigates the driving forces behind compliance in greater depth.

5.1 Overview of main descriptive results

In the following, our discussion will mainly focus on the impact of the tax regime switch, because our general results on tax compliance are very much in line with the existing experimental literature.

Figure 2 provides average results on tax compliance under the two regimes. It shows that under the progressive tax regime, the average percentage of declared income stays quite stable around 0.60, whereas it drops from 0.55 in the first period to below 0.40 in the final period of the proportionate regime. Note that we pool data in Figure 2, regardless of whether subjects experienced the progressive scheme or the proportionate scheme first. The average percentage of compliance in the progressive treatment (0.59) is significantly

higher than the average percentage of compliance in the proportionate treatment (0.45) (Wilcoxon-signed ranks test; $p = 0.025$; $N = 8$[11]).

Figure 2: Tax compliance under the two regimes

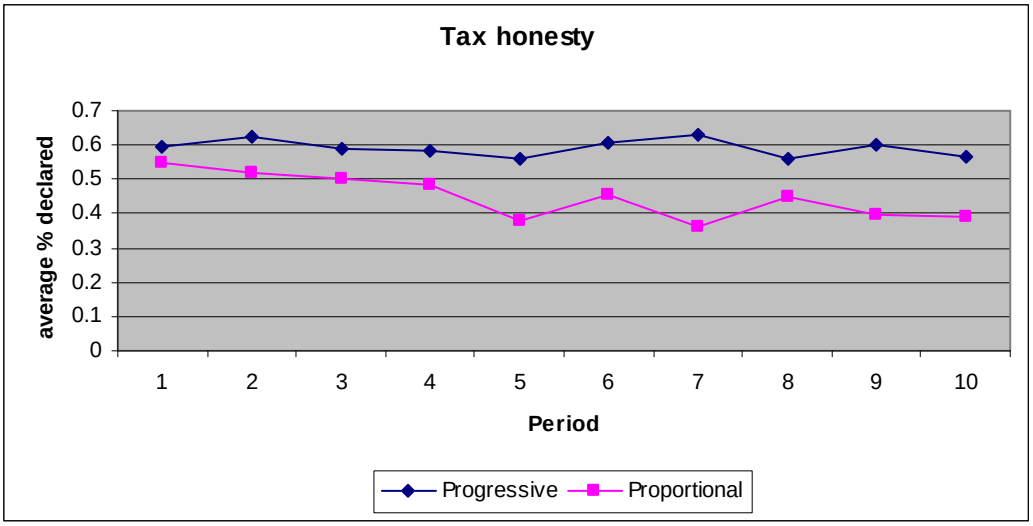


Figure 3 allows for a more disaggregated view on the effects of tax regime switches. The sessions that started with the progressive scheme exhibit a very high level of tax honesty in the initial periods which, however, decays over time. The introduction of the proportionate scheme leads to a drop of about ten percentage points in average compliance. In contrast, the average compliance is much lower in the sessions that started with the proportionate scheme. The nature of the decay, however, is very similar to the sessions with the reverse order, albeit on a much lower level of compliance. The introduction of the progressive tax regime after period 10 increases average tax compliance by about ten percentage points. Note, however, that progression as the second regime produces markedly lower compliance rates compared to progression as the first regime. For the proportionate system, the order is reversed: this regime results in larger average compliance in the second round. Of course, this descriptive view does not allow us to distinguish between the different reform effects which originate from altering incentives through changing tax rates on the one hand and the change in the tax regime as such. We will turn to these subtleties in our econometric analysis in the next subsection.

[11] Note that this is a conservative test on the level of matching group averages.

Neither do average results properly reflect the fact that there is quite some individual heterogeneity in tax compliance. We observe both subjects that always report their true income and subjects that always report zero income. Subjects also declare amounts below their true income but above zero, and quite a few subjects change their compliance behavior over the course of the experiment contingent on audits. Figure 4 provides distributional histograms of compliance under the two regimes. It is immediately obvious that tax evasion is much higher under the proportionate system.

Figure 3: Effects of the regime change

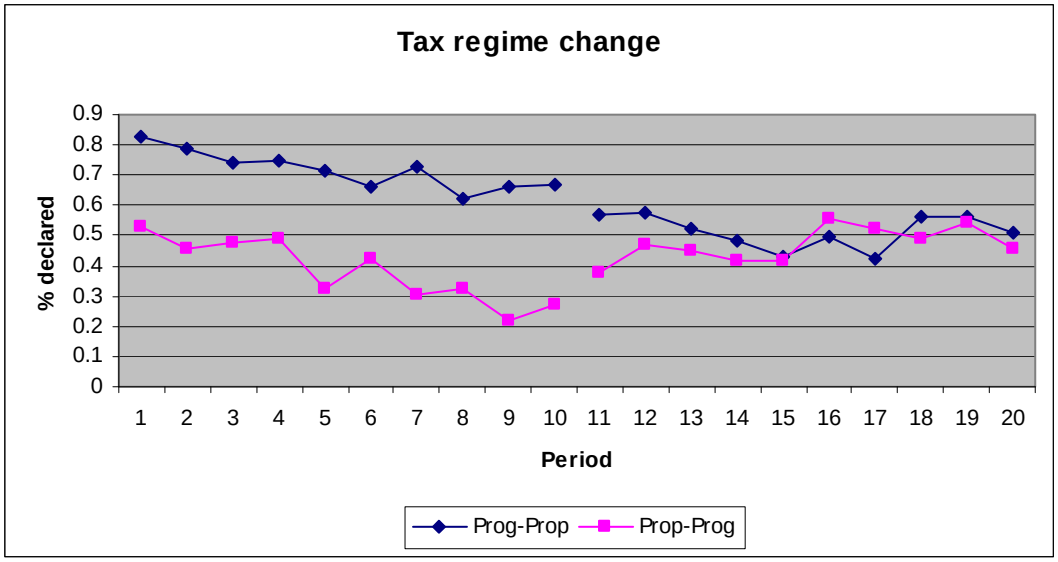
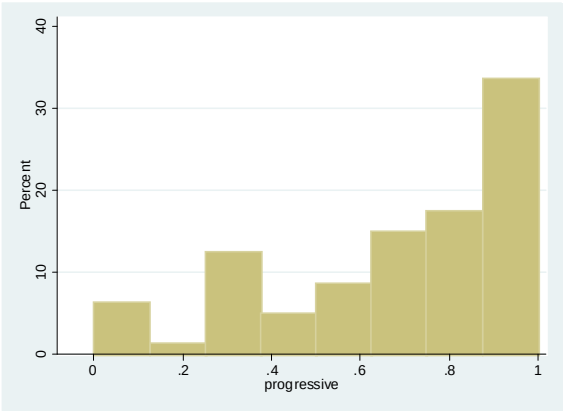
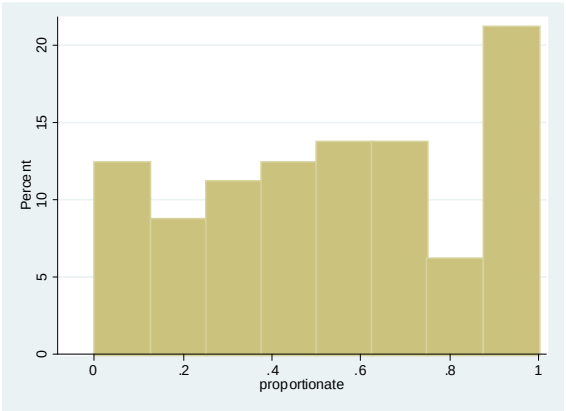


Figure 4: Distributional histograms of compliance

Panel A: Progressive tax regime



Panel B: Proportionate tax regime



5.2 Econometric analysis of compliance

Our estimation models include a full set of variables related to pure incentives in the light of the AS model. Furthermore, we control for all the variables that are potentially interesting following our hypotheses. Given the censored dependent variable we apply a Tobit regression with censoring on both sides and Huber-White standard errors. Column (1) in Table 2 presents the baseline regression. Income, risk aversion (identified form the risk test according to Holt and Laury, 2002; we simply use the number of the switching point in the choice list as the variable), and the marginal tax rate are the control variables corresponding to the AS model. We also include a number of control variables whose importance has been repeatedly demonstrated in the experimental literature: a dummy for having been fined in the previous period, a period index, and a gender dummy.

It is also known from the literature that a preceding fine tends to lower subsequent compliance. This is explained by both a misperception of probabilities and, to a weaker extent, a tendency of subjects to "repair their losses" (Maciejovsky, Kirchler and Schwarzenberger, 2007). Learning in tax compliance games also matters for the level of compliance. Usually, the degree of tax compliance decays over time during a series of repeated declarations. Concerning the impact of gender, females have been identified to have higher tax morale than males (e.g., Torgler, 2007). Note however, that it is also known that women tend to be more risk-averse than men (for an excellent overview on gender differences in economic decision making, see Croson and Gneezy, 2009). Hence, the gender effect on compliance is unpredictable if the higher tax morale of women is only a consequence of their higher degree of risk aversion for which we control separately.

Finally, we include a variable related to reciprocity (conditional cooperation); in our post-experimental questionnaire we asked subjects for their expectation of "which percentage of the participants has always declared their true gross income according to your judgment?" Since reciprocity is a key mechanism for the enforcement of social norms (Fehr and Gächter, 2000), we expect a positive correlation between the tax honesty expectation, on the one hand, and individual tax compliance on the other.

Our baseline regression reveals that the predictions of the AS-model of tax evasion are supported. An increasing income significantly increases evasion, whereas an increasing risk aversion and an increasing marginal tax rate have the opposite effect. In line with the experience from the experimental literature, tax honesty tends to decline with each new period of the experiment. Also the additional control variables prove to be important. The

dummy for a fine in the preceding period has a significantly negative impact. Female participants tend to be less honest compared to males, although this effect is only weakly significant. This stands in contrast to the standard finding of the tax morale literature that females have higher tax morale than males. However, since we control for risk aversion separately, and women tend to be more risk averse than men also in our sample, the untypical sign should not be over-interpreted.[12] As expected, the perceived tax honesty of other participants is positively linked to the share of income declared with high significance. Conditional cooperation (Fischbacher, Gächter and Fehr, 2001; Kocher et al., 2008; Fischbacher and Gächter, 2010) obviously plays a role in tax declaration decisions.

In a second step, we compare the two tax regimes. The regression in column (2) adds a proportionate tax regime dummy which shines up significantly negative. Its inclusion does not seriously affect the other explanatory variables with the exception of the marginal tax rate which loses significance. The high negative correlation of individual marginal tax rates and the proportionate tax dummy (the correlation coefficient is -0.48 and highly significant) can explain this effect. Compared to the progressive tax system, the proportionate tax tends to lower marginal tax rates for most participants which in line with the AS-model decreases compliance.

The third regression in column (3) shifts the focus towards our main interest, namely the impact of a regime change as such, controlling for pure tax rate effects. For this purpose, we try to disentangle the different potential effects of regime change. One aspect is that the change confronts tax payers with new rules, and they need to reflect individual tax paying strategies anew based on the experience from the system before the switch. We add a dummy for the second regime to account for this. A different aspect of regime change is the direction of change and the resulting reference points: It could make a difference, according to our hypotheses, whether a proportionate tax follows a progressive system or vice versa. We control for potential effects along this line of reasoning through an interaction of the second regime and the proportionate regime dummy. This interaction

[12] For our participants, the switching point risk measure is, on average, 6.7 for men and 7.1 for women. Notice that we also used another measure for risk which reflects the potentially non-linear relationship between risk attitudes and compliance. When we use a dummy variable for extreme risk aversion (for having a switching point greater than 8), the risk coefficient in the regression becomes larger in magnitude. This is exactly what one would expect.

isolates the effect of a regime change from a progressive towards a proportionate system (compared to the reversed direction as our baseline comparison).

Table 2: Driving forces behind tax compliance

Tobit regression; dependent variable: share of total income declared

	(1)	(2)	(3)
Income	-0.0005***	-0.0003***	-0.0003***
	[0.0001]	[0.0001]	[0.0001]
Risk aversion	0.1370***	0.1360***	0.1187***
	[0.0181]	[0.0179]	[0.0180]
Marginal tax rate	0.4120***	-0.1144	-0.1181
	[0.0989]	[0.1474]	[0.1457]
Fine last period	-0.3376***	-0.3204***	-0.3062***
	[0.0897]	[0.0895]	[0.0888]
Period index	-0.0115***	-0.0123***	-0.0227***
	[0.0042]	[0.0042]	[0.0084]
Female	-0.0861*	-0.0798	-0.1235**
	[0.0505]	[0.0498]	[0.0520]
Share of honest taxpayers	0.0105***	0.0105***	0.0096***
	[0.0012]	[0.0012]	[0.0014]
Constant	0.1589	0.3711**	0.6450***
	[0.1525]	[0.1547]	[0.1693]
Dummy proportionate tax regime	-	-0.3711***	-0.5104***
		[0.0746]	[0.0924]
Dummy second tax regime	-	-	0.0000
			[0.1125]
Proportionate tax * second regime	-	-	0.2802**
			[0.1137]
Gain from regime change	-	-	0.0004**
			[0.0002]
Observations	1363	1363	1363
Number of subjects	73	73	73
Pseudo R^2	0.1142	0.1236	0.1295

Robust standard errors in parentheses; */**/***: significant at 10%/5%/1%.

Finally, the tax regime change implies gains and losses from the individual perspective which may have an additional impact on tax honesty, as discussed above. We calculate an indicator of individual gains from regime change by taking the difference of the taxes paid in the first ten periods (the old regime) and the tax burden under the new regime assuming that the income in these ten periods is equal to the average income in the first ten periods. This assumption is equivalent to rational income expectations in the moment of the regime change, and it is the most obvious choice, given our method of income determination.

The second regime dummy in column (3) of Table 2 turns out to be far from being significant.[13] However, the direction of change has a significant impact: A regime change from progressive to proportionate tends to increase tax compliance compared to a change in the reverse direction, even when controlling for all other influences. This is in line with the impression from Figure 3 in the previous section. The regression in Table 2 clearly indicates that the level of compliance is lower in a proportionate system, but the change from a progressive to a proportionate regime is better in terms of compliance than the reverse change.

Result 1: Contrary to hypotheses 1 and 2, the regime switch has a significant effect on compliance if the system is transformed from a progressive to a proportionate one, even though the average level of compliance is significantly higher under the progressive system. This result holds when we control for risk aversion and the marginal tax rate. Result 1 also contradicts hypothesis 3.

Finally, individual gains or losses influence compliance as expected: Reform losers tend to step up their evasion activities. Obviously, participants use tax evasion as a strategy to "defend" themselves against reform losses. This result holds if we use the gain variable in a regression that takes only data from the second regime into account.

Result 2: In line with hypothesis 5, we find that reference levels have a significant impact on tax compliance. Those who gain from a regime change become more compliant after the change.

We ran several additional regressions in order to test for our hypotheses 3 and 4. From Table 2 it is already apparent that there is no increase in compliance when switching from a proportionate tax to a progressive tax, as hypothesized based on social preference models. In line with the basic idea from inequity aversion models, we also checked whether there is a kink in the compliance rate around an income of 1000 by adding a

[13] Note, however, that by construction the second regime dummy is highly correlated (correlation coefficient +0.87) with the period indicator. This means that we cannot disentangle whether the decreasing tax honesty over the course of the experiment is simply a consequence of time and experimental experience or also affected by the regime change.

variable that interacts the income variable with a dummy taking on the value 1 for income being larger than 1000. We also estimated a model that interacts the tax regime dummy with the income-is-larger-than-1000 dummy. Both variables are insignificant.

Similarly, our attempts to show a significant association between the fairness perception and compliance behavior failed. Regarding tax compliance, fairness considerations do not seem to play an important role, at least in our experiment.[14]

Result 3: In contrast to hypotheses 3 and 4, we do not find evidence for a significant impact of fairness considerations on tax compliance.

6 Preference over tax regimes

Before period 21 all subjects were asked to indicate their preferred tax system and told that their individually preferred system would be implemented for them for one final period under five times higher incentives than in any previous period of the experiment. Even though the respective results are mainly exploratory, we think that our results on preferences over tax regimes provide some valuable insights.

Out of the 80 subjects, 37 prefer the progressive tax regime, although 47 should do so if they were selfish, rational and risk-neutral decision-makers. Twenty-eight participants correctly prefer the progressive regime because of their low income expectations, and 24 subjects correctly prefer the proportionate regime because of their high income expectations. Interestingly, there are only nine subjects who prefer the progressive over the proportionate tax regime, although they should prefer the proportionate tax system, whereas there are 19 subjects who prefer the proportionate over the progressive tax regime, although they should prefer the progressive tax system. The first group could have some form of social preferences; the preference of the second group could be explained through an aversion against complexity, i.e., a preference for simple tax systems even at one's own cost.

Running Probit regressions in Table 3 reveals that only the average income over the periods 1-20 (i.e., the resulting income possibilities from the quiz questions) comes out

[14] For reasons of succinctness, we do not provide the regression tables here, but they are available on request.

significant in any specification. The higher the income, the more likely a subject prefers a proportionate regime. Although only marginally significant in column (2), it is interesting to note that more honest tax payers have a tendency to prefer the progressive regime, controlling for income. No other variable comes close to being significant. Not surprisingly, however, a dummy for those who win in monetary terms after the introduction of a progressive tax regime is also highly significant.[15]

Result 4: Tax regime choice is mainly driven by monetary considerations.

Table 3: Determinants of tax regime preferences

Probit regression; dependent variable: system choice (0: proportionate, 1: progressive), reporting marginal effects

	(1)	(2)	(3)
Average income	-0.0005***	-0.004***	-0.004**
	[0.0001]	[0.0001]	[0.0002]
Average tax honesty	-	0.3893*	0.1179
		[0.2271]	[0.2843]
Average fine last period	-	-	-0.0014
			[0.0011]
Female	-	-	0.0634
			[01359]
Risk aversion	-	-	0.0402
			[0.0448]
Dummy for the order of treatments	-0.236	-	0.0977
	[0.1194]		[0.1419]
Observations	80	80	73
Pseudo R^2	0.1551	0.1817	0.2101

Standard errors in parentheses; */**/***: significant at 10%/5%/1%.

A closer look at individual behavior in the final period reveals that there is not only a relationship between the tax regime and compliance – as already established before – but that there is also an association between the *preference* for a tax regime and tax compliance. Table 4 presents Tobit regressions with compliance behavior in period 21 as the dependent variable and shows that those who choose the progressive system exhibit a significantly higher degree of compliance, regardless of the controls introduced. Column (2) adds a dummy for the order of treatments (i.e., the order of experience), which is unsurprisingly insignificant for compliance in the final period. Column (3) adds two

[15] Regression results are available on request.

dummies for whether an individual complies with the standard selfish prediction (based on expected income) or not. The dummy "'Wrong' preference for progressive" means that the person should have – according to payoff maximization under risk neutrality – opted for the proportionate system but actually did not. "'Wrong' preference for proportionate" means that the participant should have preferred the progressive regime, but did not. The main result that those preferring the progressive system declare a higher share of their income remains unchanged. We do not have any explanation for the significantly negative effect of the "'Wrong' preference for progressive"-dummy.

Result 5: Participants who opted for the progressive tax regime exhibit higher levels of compliance. Supposedly, decision makers whose tax honesty is high self-select themselves into the tax regime with higher levels of redistribution.

Note finally that a gender dummy and our risk measure come out insignificant when added to the independent variables in Table 4. This is probably a consequence of the sample size for the single choice decision.

Table 4: Driving forces behind tax compliance in period 21

Tobit regression; dependent variable: share of total income declared

	(1)	(2)	(3)
Preference for progressive system	0.7010***	0.7025***	1.0114***
	[0.2215]	[0.2191]	[02741]
Dummy for the order of treatments	-	-0.1572	-0.1857
		[0.2059]	[02013]
"Wrong" preference for progressive	-	-	-0.7018**
			[0.3374]
"Wrong" preference for proportionate	-	-	0.2844
			[0.2702]
Constant	0.4068***	0.4856***	0.3730*
	[0.1406]	[0.1722]	[0.2156]
Uncensored observations	32	32	32
Pseudo R^2	0.0669	0.0703	0.1033

Standard errors in parentheses; */**/***: significant at 10%/5%/1%.

7 Discussion and conclusion

So far, the literature on tax compliance has neglected the impact of tax reforms. Therefore, the focus of this paper is on the effects of tax regime changes on tax compliance. Our tax compliance experiment which implements a specific procedure to induce entitlements over stochastic but serially correlated income replicates the major findings from previous experiments in the literature. In addition, we provide the following empirical results.

First, while expectedly, tax compliance is, on average higher, in a progressive than in a proportionate tax system, a change from a progressive to a proportionate scheme has a significantly positive impact on tax compliance compared to the reverse switch. This finding is in line with the results from recent empirical assessments of the Russian flat tax reform by Ivanova, Keen and Klemm (2005) as well as Gorodnichenko, Martinez-Vasquez and Peter (2009). What our experiment proves is that the effect is robust even when controlling for other determinants of compliance such as risk aversion, gender, or the marginal tax rate. The regime switch effect cannot be accounted for by the standard model of tax compliance. A possible behavioral explanation hints to the perceived advantages of proportionate taxation compared to a progressive system: the direct comparison may make transparency and simplicity of the proportionate system appealing which in turn could foster compliance.

Second, we find that those who gain from a regime change become more compliant, again even when controlling for all other relevant factors. Reference-level theories can easily accommodate for this effect.

Third, individual choice of tax regime is mainly driven by monetary considerations. However, we observe some influence of other-regarding concerns that seem to shape the inclination to declare taxes honestly. Participants who opted for the progressive tax regime exhibit higher levels of compliance. It might be that decision makers whose tax honesty is high self-select themselves into the tax regime with higher levels of redistribution. Furthermore, conditional cooperation is clearly present in our data. We observe increasing compliance rates with increasing expectations regarding compliance of others.

Our experiment provides implications that are potentially relevant for real-world tax reforms. Even when controlling for incentives effects, gender and conditional cooperation, there is a separate effect of the regime switch on compliance. Switching from a progressive to a proportionate system brings about a regime change premium whose size is quite remarkable in comparison to other influences. Such a premium could tip the balance in tax

reform discussions. The reverse side of the coin is that switches from proportionate to progressive systems bear an additional negative side effect that should be taken into account. However, one has to keep in mind that average compliance is lower under the proportionate than under the progressive tax system. Furthermore, reference levels and their effects on compliance have to be accounted for when a tax regime switch is assessed empirically and discussed politically.

There are lots of interesting research questions in this context down the road. One important area that has not been studied so far is the compliance effects of regime switches regarding auditing. Another interesting issue is the impact of social preferences. We deliberately made social preferences little salient in our setup, but in the real world, tax acceptance is obviously linked to redistributive preferences. Furthermore, a closer look on actually existing tax systems and discussed tax reforms with the help of experimental methods seems fruitful (see, for instance, Riedl and van Winden, 2007).

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Appendix A: Instructions [for referees' convenience; not for publication; will be made available online]

These are the experimental instructions for the sessions with the experience of the progressive tax regime first and the proportionate tax regime second. The reverse order instructions are analogous and available on request. Instructions have been read aloud prior to the session.

Welcome and thank you for participating!
Please stop talking to other participants from now on.

General

This is an experiment on economic decision making. You will earn "real" money that will be paid out to you at the end of the experiment. During the experiment you will be asked to make decisions. Your decisions and the decisions of other participants determine your earnings from the experiment according to the following rules.

The experiment will last for less than two hours. If you have any question or if anything is unclear in any phase of the experiment, please raise your hand, and one of the experimenters will come to you and answer your question privately.

During the experiment you will accumulate experimental points (EP). At the end of the experiment all EP that you earn will be converted into euro at the exchange rate of

1000 points = 1 euro.

In the interest of clarity, we will only use male terms in the following.

Experiment

The experiment consists of five parts. Usually, you will receive instructions for a part after the previous part has ended. The parts of the experiment are generally independent; in case there are interdependencies between parts (i.e. if decision in one part have consequences for another part of the experiment), we will clearly indicate that before you have to take such decisions. The sum of earnings from the five parts will constitute your total earnings from the experiment.

Anonymity

You will learn neither during nor after the experiment, with whom you interact(ed). The other participants will neither during nor after the experiment learn, how much you earn(ed). We never link names and data from experiments. At the end of the experiment you will be asked to sign a receipt regarding your earnings which serves as a proof for our sponsor. The latter does not receive any other data from the experiment.

Means of help

You will find a pen at your table. Please leave it there at the end of the experiment.

Part I

In the first part of the experiment you will be asked to answer 20 trivia question. For each question, there are four given answers, but only one of them is correct. After answering all questions on a given screen, please click the OK-button to go to the next screen. Your endowment in some of the following parts of the experiment is partly dependent on the number of correct answers that you give. The more questions your answer correctly, the higher will be your endowment. Wrong answers do not lead to deductions. At the end of part I, you will learn how many questions your have answered correctly.

Part II

[handed out together with the instructions of Part I]

Course of action

The second part of the experiment consists of 10 periods with identical course of action.

Groups

At the beginning of each period, groups of 2 persons will be formed. **In each period, there will be a new matching.** You will be matched with a randomly chosen participant, but you will not learn at any time the identity of the participants you have been matched with during the experiment.

Decisions

At **the beginning of each period**, you receive your **endowment**, **your gross income**. The level of your gross income depends on your performance in answering the trivia questions and a random component. If you have done well with the questions, the probability that you have a higher gross income increases, and vice versa. Because of the random component, your income may vary from period to period, but it will never be below 0 and above 2000 EP. On the screen you will see in any period the amount of your gross income, and you will be asked to declare your gross income. Based on your declaration the level of your tax on your gross income will be determined. The exact amount of tax can be seen in the following table.

Gross income	Tax
0	0.00
100	0.00
200	0.00
300	0.00
400	0.00
500	0.00
600	9.72
700	32.34
800	60.96
900	95.58
1000	136.20
1100	182.82
1200	235.44
1300	294.06
1400	358.68
1500	429.30
1600	505.92
1700	588.54
1800	677.16
1900	771.78
2000	872.40

Your tax amount follows the formula (DI = declared gross income)

$$\text{Tax amount} = \frac{0.45 \bullet DI \bullet (DI - 546)}{1500} \text{ if } DI \geq 546; \text{ and 0 if } DI < 546.$$

If you want to perform some calculations, just click on the calculator symbol on right-hand bottom of the screen. It opens the Windows calculator. Note that you do not have to concern yourself with the formula; the table provides enough information to support your decision.

Your *declared gross income* does not have to be equal your *actual gross income*. It can be equal to your actual gross income or lower. However, there is a **15% chance that you will be audited**. If an audit establishes that you declared a smaller amount than your actual gross income, additional points will be deducted from your profit. This deduction is increasing in the deviation of your declared gross income from your actual gross income and is calculated in the following way:

Additional deduction = 3 x (tax amount $_{\text{actual gross income}}$ – tax amount $_{\text{declared gross income}}$)

The additional deduction is thus three times the difference between

- the amount that would have been deducted if you had declared the actual gross income, and
- the amount that has actually been deducted according to your declared gross income.

Calculation of profits

As noted already, there will be groups of two – persons. In each group, the tax amount of the two members will be added up. Each member will then receive half of the amount that is in this pot. Additional deductions that occur if somebody declares less than the actual gross income do not add to this pot; they are forfeit.

To summarize, the profit of a participant in a period is calculated as follows:

Possibility 1: The participant has not been audited or the declared gross income equals the actual gross income:

Profit = Actual gross income
– Deduction from declared gross income = tax amount (according to the table or formula)
+ Refund (half of the sum of the own tax amount and the tax amount of the other group member).

Possibility 2: The participant has been audited and his declared gross income was lower than his actual gross income:

Profit = Actual gross income
– Deduction from declared gross income = tax amount (according to the table or formula)
+ Refund (half of the sum of the own tax amount and the tax amount of the other group member)
– Additional deduction = 3 times (tax amount $_{\text{actual gross income}}$ – tax amount $_{\text{declared gross income}}$).

The next period starts after the profits have been calculated and presented to the participants. Your gross income in each period depends on your performance in the first part (trivia questions) and a random component. Your earnings from a specific period will not be added to the gross income in the next period; it will be saved in a separate account. Part II ends after 10 rounds.

Part III

[handed out after completion of Part II]

Course of action

The third part of the experiment consists of 10 periods with identical course of action.

Groups

At the beginning of each period, groups of 2 persons will be formed. **In each period, there will be a new matching.** You will be matched with a randomly chosen participant, but you will not learn at any time the identity of the participants you have been matched with during the experiment.

Decisions

At **the beginning of each period**, you receive your **endowment**, **your gross income**. The level of your gross income depends on your performance in answering the trivia questions and a random component. If you have done well with the questions, the probability that you have a higher gross income increases, and vice versa. Because of the random component, your income may vary from period to period, but it will never be below 0 and above 2000 EP. On the screen you will see in any period the amount of your gross income, and you will be asked to declare your gross income. Based on your declaration the level of your tax on your gross income will be determined. The exact amount of tax can be seen in the following table.

Gross income	Tax
0	0.00
100	25.00
200	50.00
300	75.00
400	100.00
500	125.00
600	150.00
700	175.00
800	200.00
900	225.00
1000	250.00
1100	275.00
1200	300.00
1300	325.00
1400	350.00
1500	375.00
1600	400.00
1700	425.00
1800	450.00
1900	475.00
2000	500.00

Your tax amount follows the formula (DI = declared gross income)

$\text{Tax amount} = 0.25 \bullet \text{DI}$.

If you want to perform some calculations, just click on the calculator symbol on right-hand bottom of the screen. It opens the Windows calculator. Note that you do not have to concern yourself with the formula; the table provides enough information to support your decision.

Your *declared gross income* does not have to be equal your *actual gross income*. It can be equal to your actual gross income or lower. However, there is a **15% chance that you will be audited**. If an audit establishes that you declared a smaller amount than your actual gross income, additional points will be deducted from your profit. This deduction is increasing in the deviation of your declared gross income from your actual gross income and is calculated in the following way:

Additional deduction = 3 x (tax amount $_{\text{actual gross income}}$ – tax amount $_{\text{declared gross income}}$)

The additional deduction is thus three times the difference between

- the amount that would have been deducted if you had declared the actual gross income, and
- the amount that has actually been deducted according to your declared gross income.

Calculation of profits

As noted already, there will be groups of two – persons. In each group, the tax amount of the two members will be added up. Each member will then receive half of the amount that is in this pot. Additional deductions that occur if somebody declares less than the actual gross income do not add to this pot; they are forfeit.

To summarize, the profit of a participant in a period is calculated as follows:

Possibility 1: The participant has not been audited or the declared gross income equals the actual gross income:

Profit = Actual gross income

– Deduction from declared gross income = tax amount (according to the table or formula)
+ Refund (half of the sum of the own tax amount and the tax amount of the other group member).

Possibility 2: The participant has been audited and his declared gross income was lower than his actual gross income:

Profit = Actual gross income
– Deduction from declared gross income = tax amount (according to the table or formula)
+ Refund (half of the sum of the own tax amount and the tax amount of the other group member)
– Additional deduction = 3 times (tax amount $_{\text{actual gross income}}$ – tax amount $_{\text{declared gross income}}$).

The next period starts after the profits have been calculated and presented to the participants. Your gross income in each period depends on your performance in the first part (trivia questions) and a random component. Your earnings from a specific period will not be added to the gross income in the next period; it will be saved in a separate account. Part III ends after 10 rounds.

Part IV

[handed out after completion of Part III]

The fourth part of the experiment consists of **a single round**.

At the beginning of Part IV you have to decide, which of the two systems for determining your tax amount you prefer – the one in Part II or the one in Part III. After this decision you learn your gross income for this single period in Part IV. Again, your gross income in this period depends on your performance in the first part (trivia questions) and a random component, exactly as in Parts II and III.

After learning your gross income you will again be asked to declare your gross income. Again, your declared gross income does not have to be equal to your actual gross income. Contingent on which system you chose – the one from Part II or the one from Part III – your tax amount will be calculated. As in Part II and III, the rules for the additional deduction also apply in this part.

However, in this part, your monetary earnings that you make will be five times the earnings from a single period in the previous parts. In other words, dependent on your decisions, you earn five times more in this period than in a period in Parts II or III.

If you want to perform some calculations, just click on the calculator symbol on right-hand bottom of the screen. It opens the Windows calculator.

Before deciding on your preferred system, it is probably helpful to refresh your memory on the two possible systems by consulting the instructions for Parts II and III.

Part V

[handed out after completion of Part IV]

You receive **10 decision problems**. In each of the 10 problems you can choose between two **alternative lotteries**. Your decisions are only valid after you have made a decision for all problems and after your have clicked on the OK-button. Take your time for your decisions because your choice determines your earnings from the fifth part according to the rules described below.

Here is an example for such a decision problem:

Lottery X	**Lottery Y**	**Your choice**
You receive 2 EUR with probability 8/10 or 1,60 EUR with probability 2/10	You receive 3,85 EUR with probability 8/10 or 0,10 EUR with probability 2/10	□ Lottery X □ Lottery Y

If you want to perform some calculations, just click on the calculator symbol on right-hand bottom of the screen. It opens the Windows calculator.

Your earnings from Part V will be determined in the following way: First, the computer chooses one of the 10 decision problems randomly and with equal probability. The lottery that you chose for this decision problem will then be simulated and the result will be presented on your screen.

For example: Assume that the computer randomly chooses the decision problem from the table above, and your choice was lottery X. Then, the computer simulates lottery X, and you receive either 2 EUR (with probability 8/10 = 80%) or 1.60 EUR (with probability 2/10 = 20%) as your earnings from Part V of the experiment.

Please note that we are talking about euro-amount in Part V and not about experimental points! The euro-amount that you will earn in Part V will be added to the in euro converted experimental points that you have already earned in Parts I to IV. The sum will be your total earnings from the experiment.

Only you but no other participant will receive the information on your earnings. Before we pay out your earnings we ask you to fill out a short questionnaire on the screen. Then, the experiment ends. There are neither more parts nor any repetitions.

Appendix B: Questionnaire to determine endowment (translated from German) [for referees' convenience; not for publication; will be made available online]

What is the name of an international terrorist?

- Bin Einkaufen (German expression for „I am shopping")
- Bin Schifahren (German expression for „I am skiing")
- **Bin Laden** (German expression for „I am loading sth."
- Bin Kurz Weg (German expression for „I am shortly away")

The okarina is

- **A musical instrument**
- A Russian doll
- A traditional dress
- The national dish of Ukraine

Which of those buildings is not in London?

- Tower Bridge
- Globe Theater
- **Metropolitan Opera**
- Westminster Abbey
-

Which of those planets is closest to the sun?

- Mars
- Earth
- **Mercury**
- Neptune

Which of those countries did not join the European Union in 1995?

- Austria
- **Denmark**
- Sweden
- Finland

How many symphonies did Ludwig van Beethoven compose?

- 7
- 8
- **9**
- 12

Who wrote the novel „The unbearable lightness of being"?

- Michael Köhlmeier
- Patrick Süßkind
- Franz Kafka
- **Milan Kundera**

Which are the first names of the Dalton brothers in the Lucky Luke comic series?

- **Joe, Jack, William, Averell**

- Joe, Jack, William, Robert
- Joe, Jack, Walter, Robert
- Joe, Jim, Walter, Robert

Who of those ski racers has won the most Worldcup races?
- Hermann Maier
- Alberto Tomba
- **Ingemar Stenmark**
- Pirmin Zurbriggen

The name of the founder of Microsoft is
- Phil Doors
- **Bill Gates**
- Will Platforms
- Neil Windows

Which of those languages is not Slavic?
- Polish
- Russian
- **Hungarian**
- Bulgarian

The acronym AIDS stands for
- Acquired Immune Deficiency System
- **Acquired Immune Deficiency Syndrome**
- Acquired Immune Destruction System
- Accelerated Immune Destruction Syndrome

Which of those types of grain was used in ancient Egypt?
- Quinoa
- Amaranth
- **Kamut**
- Triticale

Which English King/Queen founded the Anglican Church?
- Victoria
- **Henry VIII**
- Elisabeth I
- William the Conqueror

Tilman Susato was a?
- **Composer**
- Writer
- Painter
- Freedom fighter

What is the name of a famous song of Tina Turner?
- Bride Annie
- **Proud Mary**
- Loud Gary
- John Kerry

Which of those countries was not part of the former Soviet Union?

- **Afghanistan**
- Kazakhstan
- Turkmenistan
- Uzbekistan

Who of those politicians was assassinated?

- Francois Mitterand
- Ronald Reagan
- **Itzhak Rabin**
- General Francisco Franco

Who of those persons did never win the Formula 1 championship?

- **Ralf Schumacher**
- Mika Hakkinen
- Nigel Mansell
- Jaques Villeneuve

What is the translation of the Latin phrase „Sol lucet omnibus“?

- The sun is rising.
- **The sun is shining for all.**
- The solar eclipse is beginning.
- The sun will not shine any longer.